In the United States Court of Federal Claims
OFFICE OF SPECIAL MASTERS

RYAN FARRELL,	*	
	*	No. 19-301V
	*	Special Master Christian J. Moran
Petitioner,	*	
v.	*	
	*	Filed: July 29, 2025
SECRETARY OF HEALTH AND HUMAN SERVICES,	*	
	*	
Respondent.	*	

Leah VaSahnja Durant and Glenn MacLeod, Law Offices of Leah V. Durant, PLLC, Washington, D.C., for Petitioner;
Elizabeth Andary and Emily Hanson, United States Dep't of Justice, Washington, D.C., for Respondent.

PUBLISHED RULING FINDING ENTITLEMENT TO COMPENSATION[1]

Ryan Farrell alleges that a tetanus, diphtheria, and acellular pertussis ("Tdap") vaccine caused him to suffer from neuromyelitis optica ("NMO"). Pet., filed Feb. 26, 2019. The Secretary disputes Mr. Farrell's entitlement to compensation. Both parties have supported their positions with reports and oral testimony from expert witnesses and argued through memorandum.

[1] Because this ruling contains a reasoned explanation for the action taken in this case, it must be made publicly accessible and will be posted on the United States Court of Federal Claims' website, and/or at https://www.govinfo.gov/app/collection/uscourts/national/cofc, in accordance with the E-Government Act of 2002. 44 U.S.C. § 3501 note (2018) (Federal Management and Promotion of Electronic Government Services). This means the ruling will be available to anyone with access to the internet. In accordance with Vaccine Rule 18(b), the parties have 14 days to identify and move to redact medical or other information, the disclosure of which would constitute an unwarranted invasion of privacy. Any changes will appear in the document posted on the website.

A review of the evidence and arguments shows that Mr. Farrell is entitled to compensation. The granting of entitlement is based upon petitioner establishing with preponderant evidence that the Tdap vaccine caused the NMO. The reasoning is set forth below.

I. Facts[2]

Mr. Farrell was born in 1976. He worked as an electric lineman. While working, he cut his finger. Exhibit 6 at 15-16. As a result, he received the allegedly causal Tdap vaccine on Wednesday, February 15, 2017. Id.

Due to an "inability to see out of his left eye, difficulty urinating and lower extremity numbness and tingling in the setting of a recent illness," Mr. Farrell sought care at Needham Emergency Room on Wednesday, March 8, 2017. Exhibit 5 at 10. Mr. Farrell informed the medical staff that "over the weekend he developed what sounds like a flulike illness associated with cough, congestion, malaise and subjective chills." Id. Testing for various infectious agents was negative. Id. at 11, 17. Mr. Farrell was admitted to the hospital. Id. at 5, 8.

While in the hospital, Mr. Farrell underwent two MRIs. An MRI of his head showed a hyperintense signal in the left optic nerve. Exhibit 3 at 8 (March 9, 2017) and an MRI of his cervical and thoracic spine showed a hyperintense signal from C5-6 to C7-T1. Id. Based upon these results he was diagnosed with "likely" "neuromyelitis optica." Id. This diagnosis was reached despite a lack of antibodies typically found in NMO patients.

Mr. Farrell was treated with Solu-Medrol for five days and rapidly improved. He was discharged on March 13, 2017. Exhibit 3 at 8-9.

When out of the hospital, Mr. Farrell saw a neurologist, Jacob Sloane. Dr. Sloane's impression was that Mr. Farrell suffered from NMO. Exhibit 3 at 205. The experts retained for this litigation agree with the diagnosis of NMO.

Dr. Sloane prescribed Rituxan. Rituxan "is an anti-CD19 monoclonal antibody that targets B cells that have that receptor." Tr. at 106. This drug "binds to that receptor on the B cell and creates kind of a cellular toxicity, so that depletes that B cell." Id.

[2] Relatively few medical records contribute to assessing whether Mr. Farrell is entitled to compensation. Thus, the recitation of medical records is short. For a longer presentation of medical records, see Pet'r's Pre-Hearing Br. at 2-6; Resp't's Pre-Hearing Br. at 1-7.

The course of Mr. Farrell's NMO over the next few months is generally not relevant to determining whether the Tdap vaccine caused the NMO. However, after approximately six months, Mr. Farrell sought a second opinion from a neurologist, Dr. Salvatore Napoli. Exhibit 4 at 2 (Dec. 19, 2017). Dr. Napoli obtained a history in which Mr. Farrell got cut, received a tetanus vaccine, and, three weeks later, developed vision and bladder trouble. Id. Dr. Napoli wrote that the "implication of this [tetanus] injection is unknown." Id. at 4. Dr. Napoli assessed Mr. Farrell as suffering from multiple sclerosis and NMO. He also prescribed medications. Id.

Dr. Napoli saw Mr. Farrell in December 2017, January 2018, February 2018, and March 2018. Exhibit 4 at 6-33. On March 8, 2018, Mr. Farrell reported concerns about his current medication (Cymbalta) and his job. Id. at 34. Dr. Napoli stated: "I do believe the patient is disabled from all gainful employment. I also agree that it is more likely than not that the DTaP vaccine may have triggered the onset of his NMO subtype of demyelinating disease." Id. at 35.

Dr. Napoli saw Mr. Farrell once more in March 2018 and twice in April 2018. Exhibit 4 at 38-51. Then following these appointments, Mr. Farrell saw medical professionals less frequently.

Mr. Farrell returned to Dr. Napoli on January 11, 2019. Dr. Napoli again assessed him as suffering from neuromyelitis optica. Exhibit 44 at 108. Dr. Napoli said that it was "more probable than not" that Mr. Farrell's "neuromyelitis optica and fulminant demyelination was triggered by" his "tetanus vaccination." Id.

Dr. Michael Levy saw Mr. Farrell in January 2021, February 2021, June 2021, December 2021, and February 2023. Exhibit 43 at 4, 15, 25, 32; Exhibit 51 at 4. On January 27, 2021, Dr. Levy authorized an ambulatory referral to external physical therapy for Mr. Farrell from Massachusetts General Hospital Neurology Virtual Department. Exhibit 43 at 32. On February 23, 2021, Dr. Levy saw Mr. Farrell virtually for a new patient consult. Id. at 25-27. On June 15, 2021, Dr. Levy saw Mr. Farrell again and assessed that Mr. Farrell was "a 45[-year-old] gentlemen with seronegative, monophasic neuromyelitis optica in 2017 following a vaccination." Id. at 15. Dr. Levy advised Mr. Farrell to follow-up in about six months. Id. at 18. On December 7, 2021, Mr. Farrell returned to see Dr. Levy in-person. Id. at 4, 9. Dr. Levy assessed Mr. Farrell's diagnosis as "remains seronegative NMO, likely due to a vaccine injury." Id. at 5. On February 14, 2023, Mr. Farrell returned to see Dr. Levy and Dr. Anderson. Exhibit 51 at 4. Mr. Farrell reported at this visit that he weaned off Lyrica and still feels the neuropathy

in his feet. Id. at 1. Dr. Levy and Dr. Anderson reported that Mr. Farrell's "neurological function is improving. He is exercising every day and walking. He eats well and feels healthy. He feels some sensation feelings in his hands that comes and goes." Id. Mr. Farrell was advised to follow up in two years. Id. at 4.

A record from January 13, 2021 indicates that Mr. Farrell had an "acute flare of neuromyelitis optica syndrome." Exhibit 46 at 23. A more recent record states that Mr. Farrell has improved and nearly returned to his baseline. Exhibit 51 at 1 (Feb. 14, 2023).

II. Procedural History

Mr. Farrell initiated this case by filing a petition on February 26, 2019. He periodically submitted medical records.

The Secretary evaluated this material and recommended that compensation be denied. Resp't's Rep., filed pursuant to Vaccine Rule 4, on March 12, 2020. In the Secretary's view, Dr. Napoli's January 28, 2019 letter was insufficient to establish that the tetanus vaccine caused Mr. Farrell's NMO. Id. at 9-10.

Mr. Farrell intended to obtain additional reports, either from Dr. Napoli or from an expert retained for the purpose of this litigation. Accordingly, proposed instructions were issued on March 24, 2020 and became final on April 16, 2020.

The parties developed evidence from experts over the next few years. For Mr. Farrell, Dr. Napoli wrote two reports: Exhibit 12, filed October 26, 2020; and Exhibit 39, filed June 4, 2021. Dr. Levy also wrote two reports: Exhibit 34, filed May 14, 2021; and Exhibit 41, filed November 23, 2021.[3]

The Secretary's pair of experts wrote a total of five reports. Dr. He's reports are Exhibit A, filed March 1, 2021; Exhibit E, filed October 5, 2021; and Exhibit

[3] Dr. Napoli is a board-certified neurologist, currently working as the medical director and president of the Neurology Center of New England. Exhibit 52 at 2. Dr. Napoli has written several publications in the field of neurology and demyelinating diseases, including NMO. Id. at 7.

Dr. Levy is a world-class authority in NMO with over 15 years of clinical and research expertise in the treatment of NMO. Exhibit 53. Dr. Levy was the director of the NMO Clinic at the Johns Hopkins Hospital from 2009-2019. Id. at 2. Dr. Levy managed over 425 patients with NMO while he was at Johns Hopkins. Id. at 32. Dr. Levy currently sees about 160 patients with NMO. Tr. at 130.

G, filed January 24, 2022. Dr. Cohen's reports are Exhibits C, filed March 1, 2021; and Exhibit F, filed October 5, 2021.[4]

After the experts were finished with disclosing their opinions in writing, the parties were directed to argue their positions through memoranda. Order, issued March 11, 2022. The parties did. Mr. Farrell submitted his primary brief on June 28, 2022, and his reply brief on January 3, 2023. Between those submissions, the Secretary offered his assessment through a brief filed on October 12, 2022.

A review of the evidence and arguments suggested that oral testimony was appropriate, and the parties were instructed to determine mutually convenient dates for a hearing. Order, issued March 7, 2024. The hearing took place in Boston, Massachusetts on October 3-4, 2024.

An order to show cause was issued on October 18, 2024 and advised that, based upon the evidence and arguments, Mr. Farrell was tentatively found to be entitled to compensation and specified topics that the parties should address in their post-hearing briefs. Respondent filed his post-hearing brief on February 3, 2025. Petitioner filed his response to respondent's brief on April 18, 2025. Respondent did not submit a reply.

The case is ready for adjudication.

III. Standards for Adjudication

A petitioner is required to establish his case by a preponderance of the evidence. 42 U.S.C. § 300aa–13(1)(a). The preponderance of the evidence standard requires a "trier of fact to believe that the existence of a fact is more probable than its nonexistence before [he] may find in favor of the party who has the burden to persuade the judge of the fact's existence." Moberly v. Sec'y of

[4] Dr. He is a professor of immunology in the department of immunology at Duke University Medical Center. Exhibit A at 1. Dr. He's research areas include human immune responses to viral infections, including influenza, HIV, HBV, and HCV. Id. Dr. He has served as a review expert for the NIH Study Section Cellular and Molecular Immunology-B and an ad hoc member for the NIH Biodefense Study Section. Id. at 1-2.

Dr. Cohen holds certifications in clinical neurophysiology and neuromuscular disease. Exhibit C at 1. Dr. Cohen is a professor and chair of the department of neurology at the Geisel School of Medicine and the Dartmouth Hitchcock Medical Center. Id. Dr. Cohen had a clinical practice for 39 years, diagnosing and treating an average of 10 patients a year for MS and about two to three patients a year for NMO. Id.

Health & Hum. Servs., 592 F.3d 1315, 1322 n.2 (Fed. Cir. 2010) (citations omitted). Proof of medical certainty is not required. Bunting v. Sec'y of Health & Hum. Servs., 931 F.2d 867, 873 (Fed. Cir. 1991).

Distinguishing between "preponderant evidence" and "medical certainty" is important because a special master should not impose an evidentiary burden that is too high. Andreu v. Sec'y of Health & Hum. Servs., 569 F.3d 1367, 1379-80 (Fed. Cir. 2009) (reversing special master's decision that petitioners were not entitled to compensation); see also Lampe v. Sec'y of Health & Hum. Servs., 219 F.3d 1357 (Fed. Cir. 2000); Hodges v. Sec'y of Health & Hum. Servs., 9 F.3d 958, 961 (Fed. Cir. 1993) (disagreeing with dissenting judge's contention that the special master confused preponderance of the evidence with medical certainty).

IV. Causation

Because the Vaccine Injury Table does not associate the Tdap vaccine with NMO, Mr. Farrell must pursue a claim that the Tdap vaccine was the cause-in-fact of the NMO. See Pet'r's Pre-Hearing Br. at 7-8. For causation-in-fact claims, a petitioner bears a burden "to show by preponderant evidence that the vaccination brought about [the vaccinee's] injury by providing: (1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of a proximate temporal relationship between vaccination and injury." Althen v. Sec'y of Health & Hum. Servs., 418 F.3d 1274, 1278 (Fed. Cir. 2005).

A. Althen Prong One – Medical Theory

Mr. Farrell's brief discussed a medical theory of molecular mimicry to explain how the Tdap vaccine can cause NMO. See Pet'r's Pre-Hearing Br. at 8-11. In support of his claim, Mr. Farrell relies upon an epidemiologic study and opinions from two experts specializing in diagnosing and treating NMO, Dr. Napoli and Dr. Levy.

1. Epidemiologic Study

Mr. Farrell meets his burden of proof largely due to a supporting epidemiologic study. For a lengthy discussion of the value of epidemiologic studies in the Vaccine Program, see Tullio v. Sec'y of Health & Hum. Servs., No. 15-51V, 2019 WL 7580149, at *5-8 (Fed. Cl. Spec. Mstr. Dec. 19, 2019), mot. for rev. denied, 149 Fed. Cl. 448, 475 (2020). Epidemiology is concerned with

whether a causal relationship exists between an agent and a disease.[5] The first question epidemiology addresses is whether an association exists between exposure to the agent and disease. GREEN, *supra* note 5, at 566. "An association between exposure to an agent and disease exists when they occur more frequently than one would expect by chance." Id.

In support of his claim, Mr. Farrell advanced medical articles, including an epidemiological study conducted by Dr. Levy and his colleagues in 2018. Exhibit 37 (Mealy).[6] The Mealy study is a multi-center retrospective analysis of patients with NMOSD for whom immunization history and clinical records from disease onset were available. Id. at 78.

The study identified that

> the concern with vaccines involves the potential risk of non-specific immune activation in patients with immune-mediated diseases. In this study, we investigated the association of a relapse occurring within 30, 60, and 90 days of a vaccination and compared it with the association of a relapse occurring within randomly selected dates. The goal was to determine if vaccines increase the risk of an NMOSD relapse.

Id. at 79 (internal citation omitted). Relapses were defined "across all centers as a new or worsening acute neurologic symptom lasting at least 24 [hours], associated with a change in exam localizing to the CNS and not explainable by fever, infection or metabolic condition." Id.

Ninety patients that met the 2015 diagnostic criteria for NMOSD received a total of 211 vaccinations and experienced 340 relapses. Id. The study compared the likelihood of a relapse occurring within 30, 60, and 90 days of a vaccine with the likelihood of a relapse occurring within each time point of a randomly generated date. Id. The study found that the "rate of vaccine-associated relapses within 30, 60, and 90 days was significantly higher than the likelihood of a relapse spontaneously occurring within each of the given time frames ($p = 0.034, 0.01$,

[5] Michael D. Green, et al., *Reference Guide on Epidemiology*, in REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 566 (3d ed. 2011).

[6] Maureen A. Mealy, et al., *Vaccines and the association with relapses in patients with neuromyelitis optica spectrum disorder*, 23 MULTIPLE SCLEROSIS & RELATED DISORDERS 78-82 (2018), filed as Exhibit 37.

0.016, respectively) among patients who were not on preventative immunotherapy only." Id. at 78. The study suggested that "there may be a risk of vaccination-associated relapses among untreated neuromyelitis optica spectrum disorder patients, however immunosuppressive therapy at time of vaccine may abort the risk." Id.

Ninety-five percent of relapses documented in the study were characterized as myelitis and/or optic neuritis. Id. at 79. Additionally, it was noted that "Five of the attacks were at the disease onset and eleven occurred later in the disease course." Id. Two of the five attacks that were at the disease onset were associated with the Td and Tdap vaccines. Id. at 80.

In analyzing the results, vaccines were associated with relapses in patients with NMOSD who were not on preventative immunotherapy, with the highest association occurring during the first 30 days after a vaccine. Id. at 80. The authors acknowledged that

> While the number of patients available in our cohort of a rare disease does not enable us to make any conclusions about specific vaccines, the data in MS largely mirror that in NMOSD, such that, overall, there appears to be no increased risk of relapses associated with vaccinations. However, the MS literature does not separately analyze the impact that disease modifying therapy may have on this association. Interestingly, most studies examining the relationship between MS onset and tetanus vaccination administration suggest that the vaccine may play a preventative role in MS development, and while less evidence supports this, some data suggest the same of the diphtheria vaccine. This contrasts with our findings of a disproportionate relationship between the tetanus + / - diphtheria vaccine and a subsequent relapse. Given the low number of patients receiving this vaccine in our cohort, more investigation is warranted, but this may be a result of the differing immunopathogenic mechanisms that distinguish MS from NMOSD.

Id. at 80-81 (internal citation omitted). The number of observed relapses that occurred within 30 days of a vaccine in the untreated NMOSD study population was outside the range of expectation. Id. at 81.

The authors also acknowledged that the study was limited by the inherent biases that exist in retrospective data analyses and thus, lacked rigorous controls. "Selection bias was minimized through the wide inclusion of any patients for

whom detailed vaccinations and clinical records were available, regardless of frequency of follow-up at each participating center." Id. at 82.

At the hearing, Dr. Levy explained the significance of this article in supporting a medical theory causally connecting the Tdap vaccine and NMO. In Dr. Levy's words,

> the significance [of this article] is that we'd heard from a lot of our patients that they believe that their disease was linked to vaccines. So what we did was we said, okay, we'll take your event and we'll line up all of your relapses with all of your other vaccines and see if there is a random pattern of vaccines associated with relapses or if there is a more specific pattern of potential causation. And what we found is that statistically there were more events of relapses occurring after -- immediately after, 30 days, 60 days, or 90 days after a vaccine then would be accounted for by just random activity. So statistically, it does seem to be linked.

Tr. at 147-48. Even though the article title uses the word "relapses," Dr. Levy explained that five of the patients in the study were "new onset" of the disease. Tr. at 150, 153.

The Secretary disputed that the Mealy article constituted epidemiological evidence that supported Mr. Farrell's theory. The Secretary argued, even if the Mealy article constituted epidemiological evidence, that its weight is undermined because it contains a methodological flaw in that the subject population was selected based on a pre-existing suspicion that the subjects had suffered vaccine-related relapses. Resp't's Post-Hearing Br. at 16. The Secretary argued that the Mealy article, while it "may be somewhat probative with regard to vaccines generally as triggers for *relapse* in cases of NMO, it does not provide epidemiological support for petitioner's contention that the Tdap vaccine specifically can *cause* NMO." Id. at 17 (emphasis in original). The Secretary argued that this article merits little weight in determining whether Mr. Farrell has met the required standards under prong one.

However, when Dr. Levy was questioned about the title of the study referring to only relapses in the Mealy article, he testified that was "because we use 'relapse' too loosely." Tr. at 177. Additionally, Dr. Levy testified that "But maybe even in my notes, I refer to Mr. Farrell's attack as a relapse. I might have. It's kind of a slip of the tongue, but it's not – it's not accurate to say it that way. . . . We should have been more correct in the title." Id. Dr. Levy's testimony and the

Mealy article persuasively explain how the theory of molecular mimicry explain how the Tdap vaccine can cause NMO.

The presence of an epidemiologic study finding that vaccinations are associated with an increased incidence of a disease is strong evidence favoring an award of compensation. See In re Swine Flu Immunization Prods. Liab. Litig., 508 F. Supp. 897, 907 (D. Colo. 1981) ("Where, as here, the exact organic cause of a disease cannot be scientifically isolated, epidemiologic data becomes highly persuasive"), aff'd sub nom. Lima v. United States, 708 F.2d 502 (10th Cir. 1983); In re Agent Orange Prod. Liab. Litig., 611 F. Supp. 1223, 1239 (E.D.N.Y. 1985) (stating that in mass tort cases, "epidemiologic studies on causation assume a role of critical importance"), aff'd sub nom. In re Agent Orange Prod. Liab. Litig. MDL No. 381, 818 F.2d 187 (2d Cir. 1987). Epidemiologic studies often fail to detect an increased incidence, and special masters may consider the lack of a positive finding in an epidemiologic study in denying compensation. See Tullio. When the opposite occurs, a special master should also consider this evidence to determine where the weight of the evidence preponderates. Andreu v. Sec'y of Health & Hum. Servs., 569 F.3d 1367, 1380 (Fed. Cir. 2009) ("Medical literature and epidemiological evidence must be viewed, however, not through the lens of the laboratorian, but instead from the vantage point of the Vaccine Act's preponderant evidence standard."). Here, the Mealy epidemiological study, while not required to support a claim, provides ample support for a reputable theory establishing how a Tdap vaccine can cause NMO.

2. Expert Opinions on Molecular Mimicry

Dr. Napoli and Dr. Levy opined that molecular mimicry is a mechanism by which tetanus vaccines can cause NMO. Dr. Napoli and Dr. Levy provided persuasive evidence explaining the medical mechanism that is believed to cause NMO. Dr. Napoli explained that

> Vaccinations are composed of organic compounds of viral or bacterial origin. These are meant to stimulate an immune response when injected. If the antigen present on the vaccine shares any homologies with host antigen, then immune response will be directed at both the injected antigens and host antigen leading to an autoimmune response. This is known as molecular mimicry which is a well-known response in immunology (Lahesmaa et al. Clin Exp Immunol 1991 86(3): 399-404). As previously noted, AQP-4 has been identified as the protein present in astrocytes which is the target for specific NMO antibodies. Molecular mimicry has been linked to the development of NMO due

> to the similarity in epitopes of AQP-4 water channels and antigens, examples such as Hep B vaccination.

Exhibit 12 at 6. Dr. Levy opined that

> The specific components of the Tdap vaccine are used in mouse models to trigger immune mediated neurological injury, especially the pertussis toxin (the "p" of the Tdap vaccine), which is hypothesized to transiently break down the blood brain barrier and permit the immune system to invade the nervous system. Molecular mimicry has been demonstrated in mouse models of neuromyelitis optica where immunization with the ABC water transporter of the Campylobacter bacterium that shares homology with the aquaporin-4 can recapitulate the human disease phenotype.

Ex. 34 at 3.

The Secretary argued that Mr. Farrell's theory is not sufficiently detailed or specific to meet the requirements of prong one of Althen. In contesting Mr. Farrell's claim, the Secretary submitted reports from Dr. He and Dr. Cohen. Exhibit A, E, G; Exhibit C, F.

The Secretary also advanced testimony and articles arguing that recent evidence undermines the theory of molecular mimicry. The Secretary's expert, Dr. He, opined that evidence of cross-reactivity alone does not support the conclusion that the Tdap vaccine can cause NMO because cross-reactivity happens constantly. Exhibit E at 6. Dr. He also testified that homology is not enough to establish molecular mimicry. Tr. at 276-78. Dr. He submitted three articles to support his opinion. Exhibit A, Tab 11 (Kanduc);[7] Exhibit A, Tab 12 (Trost);[8] Exhibit A, Tab 13 (Kusalik).[9] These articles focus largely on amino acid sequences through the human proteome. The Secretary contended that evidence "of sequence homology and cross-reactivity are components of molecular mimicry, but do not demonstrate that a pathological outcome is likely, or even possible." Resp't's Post-Hearing Br.

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[7] Darja Kanduc, et al., *Massive peptide sharing between viral and human proteomes*, 29 PEPTIDES 1755-66, 1755 (2008), filed as Exhibit A, Tab 11.

[8] Brett Trost, et al., *Bacterial peptides are intensively present throughout the human proteome*, 1 SELF/NON-SELF 71-74, 71 (2010), filed as Exhibit A, Tab 12.

[9] Anthony Kusalik, et al., *Widespread and ample peptide overlapping between HCV and* Homo sapiens *proteomes*, 28 PEPTIDES 1260-67, 1260 (2007), filed as Exhibit A, Tab 13.

at 20. However, Mr. Farrell's experts and articles support preponderantly that molecular mimicry is a reliable theory, even if it is not accepted at a level of scientific certainty.

Dr. Levy disagreed with Dr. He and testified that molecular mimicry is

> the best mechanism we have. We don't really have another good explanation for why this would happen, but I should say it's the basis of almost all of our neuroimmunological mechanisms. There has to be some reason the immune system makes this mistake. So molecular mimicry is the best explanation for why the immune system would make this mistake.

Tr. at 155. Dr. Levy also testified that he thinks molecular mimicry is still "a very valid general mechanism." Tr. at 157.

3. Assessment

To the extent that the parties disagree, Mr. Farrell has provided sufficient, preponderant evidence to demonstrate a reputable medical theory that supports that Tdap vaccination can cause NMO through the mechanism of molecular mimicry. The Mealy epidemiological study, combined with the expert reports and testimonies of Mr. Farrell's treating doctors tilts the evidence in Mr. Farrell's favor, helping him establish his claim preponderantly. Unlike in some other cases that may rely on expert opinions and case studies to try and establish their claim to entitlement, the addition of an epidemiological study provides the level of preponderant support to demonstrate how molecular mimicry is a viable mechanism to establish how a Tdap vaccine can cause NMO. While epidemiological studies are not necessary to prove a successful claim in the Vaccine Program, here, this study provides enough support beyond vaguely raising molecular mimicry as a possible biological mechanism as to how a vaccine can cause a disease.

Under the circumstances in which an epidemiologic study supports a finding that a vaccine can cause an injury and in which the Secretary has not meaningfully contested a proposed theory, an in-depth exploration of the theory is not required. The epidemiologic study persuasively shows that the Tdap vaccine can cause NMO. How that occurs---whether by molecular mimicry or some other means---is much less important than the showing that it does occur. See Lane v. Sec'y of

Health & Hum. Servs., No. 19-501V, 2024 WL 3584871, at *5 (Fed. Cl. Spec. Mstr. June 7, 2024).

For these reasons, Mr. Farrell has met his burden of proof regarding prong one. Thus, the remaining Althen elements are considered.

B. Althen Prong Three – Timing

Althen's third prong requires "a showing of a proximate temporal relationship between vaccination and injury." 418 F.3d at 1278. The timing prong actually contains two parts. A petitioner must show the "timeframe for which it is medically acceptable to infer causation" and the onset of the disease occurred in this period. Shapiro v. Sec'y of Health & Hum. Servs., 101 Fed. Cl. 532, 542-43 (2011), recons. denied after remand on other grounds, 105 Fed. Cl. 353 (2012), aff'd without op., 503 F. App'x 952 (Fed. Cir. 2013).

The medically acceptable timeframe depends, at least in part, on the theory being offered. Langland v. Sec'y of Health & Hum. Servs., 109 Fed. Cl. 421, 443 (2013).

Mr. Farrell argued that he has produced evidence showing a proximate temporal relationship between vaccination and onset of his NMO symptoms. Mr. Farrell presented opinions from Dr. Napoli and Dr. Levy regarding a timeframe from which an inference of causation is appropriate. Dr. Napoli opined that an onset of NMO symptoms occurring within five weeks and up to 10 weeks after vaccination is an appropriate timeframe for causation. Exhibit 12 at 7. Dr. Levy opined that "vaccine associated attacks" such as NMO "most often occur within the first 30 days from the jab, but can rarely occur 60 or even up to 90 days later in rare cases." Exhibit 34 at 2.

Dr. Napoli's and Dr. Levy's opinion that the onset of NMO 21 days post-vaccination is also supported by the Mealy article. Vaccine associated relapses were defined as those relapses that occurred "within 30, 60 or 90 days following an immunization." Exhibit 37 (Mealy) at 79.

For the second part of Althen prong three, Mr. Farrell argued that his NMO symptoms arose within the medically acceptable timeframe proposed by Dr. Napoli and Dr. Levy. Pet'r's Post-Hearing Br. at 51. Dr. Napoli opined that "to a reasonable degree of medical certainty that the vaccination on February 15, 2017, more probably than not, caused and triggered symptoms that Mr. Farrell experienced after, with subsequent visit to Beth Israel Medical Center on March 8, 2017." Exhibit 12 at 7. Dr. Levy agreed with Dr. Napoli that "the chronology

between the time of the vaccination and the onset of [NMO] symptoms 3 weeks later" was "well within the accepted time period for a vaccine induced neuro immunological injury." Exhibit 34 at 4.

Dr. Napoli's and Dr. Levy's opinion that the onset of NMO 21 days post-vaccination is also supported by the Mealy article. Vaccine associated relapses were defined as those relapses that occurred "within 30, 60 or 90 days following an immunization." Exhibit 37 (Mealy) at 79.

> The 30-day time point was chosen as the primary analysis based on a large study that suggested there was no increased association of any CNS demyelination beyond 30 days from time of vaccine administration (Langer-Gould et al., 2014), and the analysis was extended in this study to 60- and 90-day time points based on case reports of temporality of vaccination to relapse in NMOSD beyond 30 days (Menge et al., 2012).

Id.

The Secretary disputed that Mr. Farrell provided any evidence to support that the Tdap vaccine can cause NMO in any timeframe, which makes it impossible to affix a time period in which it would be acceptable to infer vaccine causation. The Secretary argued that Dr. Napoli and Dr. Levy acknowledged in their testimony that their primary support for the causal theory is based simply on timing, which is insufficient to show a causal link between the Tdap vaccination and Mr. Farrell's NMO. Resp't's Post-Hearing Br. at 30 citing Tr. at 26, 202.

However, Mr. Farrell argued that the Secretary's expert, Dr. He, conceded that the appropriate timing is met. Dr. He opined that

> Indeed, Mr. Farrell's vaccination on February 15, 2017, and his symptoms after vaccination with subsequent visits at the Beth Israel Medical Center on March 8, 2017, are consistent with the temporal relationship between the receipt of Tdap vaccination and his NMO disease development (meaning that the time frame between the receipt of the vaccination and the development of NMO symptoms is medically possible).

Exhibit A at 7; Tr. at 326.

Here, Mr. Farrell has met the requirements of prong three of Althen with preponderant evidence. Mr. Farrell has established an acceptable medical theory

that NMO symptoms can develop within 30 days post-vaccination and that his symptoms did occur within 21 days post-vaccination.

C. Althen Prong Two – Logical Sequence

The remaining Althen prong requires a preponderant presentation of "a logical sequence of cause and effect showing that the vaccination was the reason for the injury." Althen, 418 F.3d at 1278. With respect to this prong, the Federal Circuit has instructed special masters to consider carefully the views of a treating doctor. Capizzano v. Sec'y of Health & Hum. Servs., 440 F.3d 1317, 1326 (Fed. Cir. 2006) ("medical records and medical opinion testimony are favored in vaccine cases, as treating physicians are likely to be in the best position to determine whether a 'logical sequence of cause-and-effect show[s] that the vaccination was the reason for the injury'") (quoting Althen, 418 F.3d at 1280).

Recommendations to avoid certain vaccines have been credited and have not been credited as indications of a causal role for a vaccine. Compare Paterek v. Sec'y of Health & Hum. Servs., 527 F. App'x 875, 884 (Fed. Cir. 2013) (stating given the testimony of a treating doctor, "the decision to withhold future administration of the pertussis vaccine provides little probative evidence of causation"); Gramza v. Sec'y of Health & Hum. Servs., 139 Fed. Cl. 309, 335-36 (2018) (ruling that the special master was not arbitrary in refraining from giving decisive weight to a note from a treating doctor advising "no future vaccination" when the treater wrote the note three years after the incident); and Bangerter v. Sec'y of Health & Hum. Servs., No. 14-1187V, 2022 WL 439535, at *29 (Fed. Cl. Spec. Mstr. Jan. 18, 2022) (although a recommendation to avoid future vaccinations has some value, this evidence does not carry petitioner's burden on prong two when petitioner failed to meet prongs one and three) With Andreu v. Sec'y of Health & Hum. Servs., 569 F.3d 1367, 1377 (Fed. Cir. 2008) (the opinion of a treating doctor to withhold future vaccines can be quite probative); and Robinson v. Sec'y of Health & Hum. Servs., No. 14-952V, 2021 WL 2371721, *1376-77 (Fed. Cl. Spec. Mstr. Apr. 12, 2021) (evidence that treating doctor withheld vaccines helps support prong two).

Mr. Farrell argued that he has produced evidence of a logical sequence of cause and effect showing that the Tdap vaccination was the reason for Mr. Farrell's NMO. Pet'r's Post-Hearing Br. at 33-50. Mr. Farrell asserted that Dr. Napoli's credible testimony reinforced Mr. Farrell's claim "that the Tdap vaccine was a trigger and causative of the patient's subsequent NMO." Tr. at 33. Importantly, Dr. Napoli, as both an expert and treating physician, is afforded considerable weight when assessing a logical sequence of cause and effect. Dr. Napoli also

opined that it was "more probable than not that the [Tdap] vaccine may have triggered the onset of [Mr. Farrell's] NMO subtype of demyelinating disease." Exhibit 4 at 35.

Mr. Farrell argued that Dr. Levy's opinion on vaccine causation is based upon more than simply temporal relation and lack of alternative causes. Mr. Farrell asserted that Dr. Levy's opinion is based on "solid scientific evidence, including numerous published peer reviewed scientific research and studies, including of his own epidemiologic studies (*Mealy*), as well as the specific facts and circumstances of Mr. Farrell's illness." Pet'r's Post-Hearing Br. at 38 (emphasis in original). Dr. Levy opined that "The cause of [Mr. Farrell's NMO] attack is most likely related to a vaccine Mr. Farrell received just prior to the attack on February 17, 2017." Exhibit 34 at 2. Dr. Levy explained that Mr. Farrell's "attack occurred starting 14 days after immunization. There is nothing else in Mr. Farrell's prior history that could confound the chronological link such as the use of immunosuppressive medication or known autoimmune disease." Id.

Dr. Levy opined that

> In Mr. Farrell's case, an aquaporin-4 antibody was not present at the time of the time suggesting that a different immunological antigen was the target in his case. Since March 2017, a new neurological target called myelin oligodendrocyte glycoprotein (MOG) was found to be to be present in up to 40% of patients with neuromyelitis optica who test negative for the aquaporin-4 antibody. At the time of Mr. Farrell's attack, the MOG antibody test was not available. Notably, this antibody does not remain in circulation in the majority of patients beyond 6-12 months after an attack. Mr. Farrell tested negative for the MOG antibody when it became commercially available but that does not necessarily mean MOG was not the target of his attack. In my lab, we continue to search for additional neurological antigens of aberrant immune attacks.

Id. at 3-4. Dr. Napoli testified that in his own practice, with a patient like Mr. Farrell, he "would not recommend [Mr. Farrell] get the Tdap vaccine, and I suspect 95 percent of providers would agree with that." Tr. at 41. When asked whether he would advise Mr. Farrell to get a Tdap vaccine, Dr. Napoli stated that he would advise Mr. Farrell not to get "this specific vaccine, the Tdap." Id. at 95. When Dr. Napoli was asked how he would advise Mr. Farrell if Mr. Farrell had stepped on a rusty nail, he testified that he would talk to Mr. Farrell's team of doctors and

specialists to weigh the risks and benefits of vaccination, if he was on an immunosuppressant treatment. Id.

> So there may be the possibility that a team approach might say, hey, maybe you should get it, because the risk of having tetanus might be higher than NMO again, but we're not sure what that risk is. And, ultimately, he'd have to make the decision, you know, if he wanted to do it. So in that scenario, it's a great example of – how we approach in the offices that scenario, probably work as a team, bring in other providers involved in coming up with the benefits and also what could happen.

Id. at 96. Similarly, Dr. Levy testified that he usually advises his patients "to receive a vaccine because all of my NMO patients are treated, and we know that treated patients who take vaccines have better outcomes." Id. at 189.

Dr. Levy, like Dr. Napoli, is one of Mr. Farrell's treating physicians and Mr. Farrell argues that Dr. Levy's testimony is entitled to significant weight. Pet'r's Post-Hearing Br. at 37.

The Secretary argued that Mr. Farrell's causation theory is insufficient to prove a logical sequence of cause and effect. Resp't's Post-Hearing Br. at 24-26. The Secretary points to the progression of the strength of Dr. Napoli's opinion regarding causation throughout the course of treatment. The Secretary asserted that because Dr. Napoli's opinion progressed from "[t]he implication of [the Tdap] injection is unknown," Exhibit 4 (December 19, 2017) at 2, to a few months later stating that it was "more probable than not that [the Tdap] vaccine may have triggered the onset of [Mr. Farrell's] NMO subtype of demyelinating disease," Id. (March 8, 2018) at 35, then to it was "more probable than not, that [Mr. Farrell's] diagnosis [w]as related to the Tdap vaccination," Exhibit 7 (September 6, 2018) at 1, and finally escalating his opinion to being "more likely than not triggered" by the February 2017 Tdap vaccination, Exhibit 9 (January 28, 2019) at 2, weakens the credibility of his opinion because it was written just under one month before Mr. Farrell filed his petition for vaccine compensation. Resp't's Post-Hearing Br. at 24-25.

The Secretary argued that Dr. Napoli's opinion did not provide anything other than temporal proximity to support his revised opinion. The Secretary maintained that Dr. Napoli's opinion of vaccine causation should be assigned little weight. Resp't's Post-Hearing Br. at 25.

Similarly, the Secretary contended that Dr. Levy's opinion that Mr. Farrell's NMO was caused by the Tdap vaccine relies solely on the proximate temporal relationship and lack of other explanations is not sufficient to demonstrate causation. Resp't's Post-Hearing Br. at 26.

The Secretary next argued that there were alternative causes reasonably raised in the record, even if the Secretary did not pursue a formal alternative cause argument. Id. The Secretary pointed to medical records that undercut Mr. Farrell's claim of vaccine causation, specifically symptoms of a viral illness prior to his neurological disease onset, even if the specific infectious agent behind Mr. Farrell's symptoms was not identified. Testimony from Dr. Cohen and Dr. He underscored the Secretary's argument and opined that a wild pathogen causes a "much stronger" immunologic response than a Tdap vaccine. Tr. 290-92. The Secretary disputed whether Mr. Farrell has met his burden under prong two of Althen. Resp't's Post-Hearing Br. at 23-29.

Mr. Farrell responded to Dr. He's assertion that a flu-like illness was far more likely to have caused a "potent immunological stimulus," triggering Mr. Farrell's NMO as being nothing more than conjecture. See Exhibit G at 3; Pet'r's Post-Hearing Br. at 39. Mr. Farrell argued that he was never diagnosed nor treated for an infectious illness prior to the onset of his NMO. Id. Mr. Farrell's NMO started on March 3, 2017 or March 4, 2017. On March 8, 2017, Mr. Farrell's doctor noted that he had a flu-like illness one week prior, placing the flu-like symptoms on March 1, 2017 at the earliest. Mr. Farrell argued that even if he had a "viral illness" on March 1, 2017, that would be too soon to have caused Mr. Farrell's NMO two days later. See Exhibit 3 at 31; Tr. at 124-25, 181-82. Additionally, Mr. Farrell's experts contended that all Mr. Farrell's reported non-specific symptoms of a viral illness can also be associated with NMO. Tr. at 51, 161-63.

Based on the record as a whole, it appears more likely than not that Mr. Farrell has established a logical sequence of cause and effect, supported by his treating doctors, that the Tdap vaccine caused his NMO. As such, Mr. Farrell has met his burden under prong two of Althen.

D. Summary regarding Causation

To establish the vaccine was the cause-in-fact of an injury, a petitioner must establish three elements. The undersigned has reviewed all expert reports, articles, witness testimony, and briefs submitted by the parties. In this case, the evidence preponderates in Mr. Farrell's favor. Mr. Farrell provided persuasive expert

opinions, supported by reliable medical articles, to meet his burden on all three elements. The Secretary has not met his burden regarding alternative causation.

V. Conclusion

As evident in medical records and consistent with Mr. Farrell's experts and treating doctors, Mr. Farrell has preponderantly established that he is entitled to compensation. A separate order regarding damages will issue.

IT IS SO ORDERED.

s/Christian J. Moran
Christian J. Moran
Special Master